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ABSTRACT

Before developing a curriculum for radiologic technology, one must first attempt to define the term "curriculum." The term is not easy to define precisely, although it does imply the necessity of a master plan that outlines institutional philosophy and goals, course descriptions, description of competency-based evaluation, performance objectives, policy, and outcome assessment processes. Following from the curriculum, a syllabus offers an instructor's personal expression of course content. The process of curriculum development can be very complicated or very loose. Radiology instructors are advised to take a "middle ground" to develop a curriculum and a syllabus that is 5-10 pages long and communicates the essence of a course. The components of the curriculum should include the following: a philosophy statement, a rationale, learning outcome statements (competencies), learning activities, assessment of competency attainment, and specifics of the learning environment. It is important that "curriculum alignment" be considered a focus of curriculum development. This term refers to the agreement between learning outcome statements, learning activities, and the assessment of competency attainment. The radiologic technology curriculum must prepare students to meet minimal criteria for a standardized examination. It must also meet other criteria imposed internally (such as rules of the college) and externally (such as practice at the clinical site). An eight-step methodology can be used for defining curriculum: (1) validate present course content through task analysis; (2) agree on the syllabus format; (3) agree on scope and sequence of the material; (4) write the objectives from simple to most complex; (5) align the objective written with the texts used; (6) carry out the curriculum; (7) align evaluation measures with the curriculum; and (8) review and evaluate the curriculum and improve the syllabus. (KC)

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CURRICULUM DEVELOPMENT AND ALIGNMENT IN RADIOLOGIC TECHNOLOGY

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ABSTRACT

This article describes curriculum in special reference to radiography education. Curriculum is defined, the components of a curriculum document are presented, and the essential element of curriculum development, curriculum alignment, is discussed.

CURRICULUM DEFINED

Curriculum is the essence of any program, including one in radiologic technology. Curriculum must meet the needs of students and future employers. However, curriculum is a term that does not always have a firm definition. In a well-known textbook on curriculum, McNeil does not define the term at all.[1] However, a knowledge of the essence of curriculum is necessary before development and implementation. English defines curriculum as the adoption of a set of recurring responses to a set of recurring circumstances.[2] Also, it involves any search for human competence and development. It is a means to an end.

Although in a broad sense, the entire accreditation process through the JRC-ERT *Essentials* focuses on curriculum, section III of this document specifically adresses curriculum.[3] Key to this section is the requirement of a program *Master Plan* . This document outlines institutional philosophy and goals, cu .culum, course descriptions, description of competency-based evaluation, performance objectives for clinical education, graduate competencies, evaluation, program policy, and outcome assessment process. The *Master Plan* should be viewed as the broadest application of curriculum in a radiography program.

To be effective, curriculum must be formalized. Most faculty prepare and revise the basic form of curriculum, the syllabus. A syllabus, which communicates to students the scope and requirements of a course, should not parrot the adopted

textbook. This fact has been misunderstood, and some faculty prepare a syllabus that mimics a text almost in whole. A syllabus is most often a personal expression of course content.

The purpose of a syllabus is to:

1. Help to organize the course for the instructor and student.
2. Establish communication between instructor and student.
3. Provide structure for the course.
4. Help the student to discover personal responsibilities for the course.
5. Give security to the instructor and student through communication of course content.

If there is little agreement on a definition for curriculum, it might also be expected that there is also little consensus for process and format in curriculum. For example, Diamond recommends a seventeen(!)-step process for the development of the curriculum document, which he calls a "student manual."[4] This very comprehensive document would be purchased by the student. In contrast, McKeachie's method of curriculum development, described in his text for beginning college instructors, is so loosely defined that it is difficult to determine what he really considers appropriate.[5] Also, institutions tend to have a process in place for curriculum development. More often than not, this process, with the exception of curriculum approval through committee consensus, is informal.

Many radiologic technology educators would not have sufficient time to develop a document to the extent of that called for by Diamond. However, many would also be very uncomfortable with a laissez-faire system of development as described by McKeachie. Radiography educators, especially those employed by community colleges, traditionally have large teaching loads. This precludes the development of large amounts of supplementary material. Yet there is also a strong professional recognition that courses should be well-defined for entry-level students.

The remainder of this article will describe a "middle ground" of curriculum development. That is, the development of a syllabus will be described. This document is typically from 5 to 10 pages long and communicates the essence of a course. The components of a curriculum document (syllabus) and the process of curriculum alignment will be described.

CURRICULUM COMPONENTS

The necessary components of a syllabus are:

- Philosophy Statement - presents a philosophical position for the course and relates it to the institutional and professional mission.
- Rationale - builds a case for the importance of the content to the learner.
- Learning Outcome Statements (Competencies) - details the cognitive, affective, and psychomotor learning outcomes the course is designed to help learners attain.

- Learning Activities - specifies the appropriate facilitators of learning, including instructional resources and media.
- Assessment of Competency Attainment - outlines procedures to be used in documenting competency attainment.
- Learning Environment - specifies those environmental factors and program policies essential for learning.[6]

The first two items are sometimes ignored in curriculum documents. When self-study begins, the philosophy must first be reviewed for congruence between institutional mission and program (course) goals.[7] This step should not be left out to more quickly concentrate on professional content. Certainly, professional relevance of the curriculum is important. However, beyond the minimum expected of any radiologic technology curriculum - producing competent graduates able to pass the national certification exam - there is great possible variance in curriculum. There is no reason why patient care courses should be, for example, identical from program to program. Beyond essential competencies, there are a variety of variables. These include institutional philosophy, the way patient care is practiced in affiliated institutions, and the student population, to name a few. Human competence is not so discrete that it is easily packaged for mass consumption.

Also, students often ask why they have to learn certain material. Ideally the rationale statement should solve this

problem. It gives the course a stated focus and relevance. Sometimes instructors assume that what they see as important will be seen as important by students. Yet today students are more prone to ask why.

Rationales also help when it comes time to face the dreaded curriculum committee. A critique often leveed against these committees is that they rarely represent a good cross-section of the institution. This may or may not be true. Developing detailed rationales at the outset is superior to assuming that a proposed curriculum will be accepted.

Philosophy and rationale statements also set the stage for important curriculum decisions. For example, the JRC-ERT has recently interpreted Essential III.B.9 as it relates to mammographic learning experiences.[8] This includes documentation of competency for all students, including males.

In some isolated areas of the country, there is no problem with males performing mammography. This is the exception rather than the rule. The JRC has stated that "program faculty must be creative and innovative to develop alternate learning experiences (videotapes,slides) and valid methods for evaluating competency through simulation in the laboratory" for male students. This process of being innovative will require first, an attention to institutional philosophy, that then translates into an acceptable rationale.

CURRICULUM ALIGNMENT

The remainder of this article will focus on *curriculum alignment*. This is the agreement between Learning Outcome Statements, Learning Activities, and the Assessment of Competency Attainment. English defines curriculum alignment as "the determination of the congruence between the written curriculum (in whatever form it is used in the workplace) and work measurement (tests or whatever manner the work is assessed)."[2]

Curriculum alignment is probably best understood through one or more examples. When taking a driver's test, a booklet is given to the student that covers the various "Rules of the Road." This document is the curriculum, and the driver's test is ideally aligned with the booklet. This is not the entire set of laws for driving, but a guideline for the student.

Another example is the use of standardized tests for promotion in elementary, secondary, and sometimes higher education. As these tests have developed, educators have had to develop curriculum that prepares students for the test and meets other goals. Radiologic technology educators face a similar curriculum development process in that the stated program must meet minimal criteria for a standardized examination. It must also meet other criteria imposed internally (eg., rules of the college) and externally (practice at the clinical site).

To have true curriculum alignment, there must be a precise agreement between three items: Learning Outcome

Statements, Learning Activities, and the Assessment of Competency Attainment. Curriculum alignment should be the first item that committee members look for in a proposed curriculum. A curriculum document might be able to "limp by" without a rationale, a philosophy statement, or the specification of a learning environment. The other three items are essential.

Learning outcome statements tell what will be taught. A description of activities tells how the course is going to get to the desired end-point. The knowledge that an end-point has been acheived comes through an assessment of competency. Pautler gives an eight-step methodology for aligning curriculum.[9] These are described below.

Step 1 - Validate present course content through task analysis

In radiologic technology, the ARRT task analysis is a good first reference. However, there is also much that is not covered in this task analysis. As described earlier, mammography is a special case that requires a look at institutional philosophy and local health care practices. Venipuncture is another topic that will require special attention in developing appropriate levels of competency. For example, in a state where it can reasonably expected that graduates will perform venipuncture, it might be appropriate to develop large-scale learning activities that include extensive lecture and clinical experience. In a state where the nursing practice act forbids the performance of venipuncture by radiographers, this may involve a

"lower level" of competency. The mediating factor will be the scope of practice of the profession.

Step 2 - Agree on the syllabus format

Ideally all syllabi in a program such as radiologic technology should have a fairly identical syllabus format. This provides guidelines to students and other faculty that are consistent and encourage equity in education. An instructor might argue, for example, that institutional academic freedom allows for a syllabus that does not resemble others in the program. This limits student learning and program effectiveness.

Step 3 - Agree on scope and sequence of the material

The term agreement indicates a group process. Although the educator might be a content expert, curriculum is poorly developed in a vacuum. Ideally, faculty in a radiography program offer course syllabi to colleagues for periodic review. Alternatively, an educator in a small program might use professional colleagues in the state society or other group for review. Peer review is a difficult process, as authors of scholarly manuscripts can attest, but it is necessary to ensure validity of the material. Creativity stagnates without criticism.

Step 4 - Write the objectives from simple to most complex

Greathouse also indicates that objectives and course content should proceed from simple to complex. Here it may become evident that the text intended has a few gaps that must be supplemented by the instructor. This might include, for example, a poor coverage of image intensification in a physics text. Today

more texts are available than ten years ago, when text choice was limited. This step logically flows into step five. Some authorities believe that these steps are fairly synonymous and interchangeable.

Step 5 - Align the objective written with the text(s) used

If there is poor agreement, there are three options: choose a new text, develop supplementary materials, or rewrite the objectives. In actuality, often only options 1 or 2 are feasible.

Although rare, it is still possible to find curricula that assign one text to the students while the instructor uses another for class preparation. This is sometimes practiced by inexperienced educators unsure of their own abilities in teaching ability and content expertise.

Ideally, objectives have been written based on the text. One good, quick way to start beginning instructors on a path to sound lecturing is to prepare lecture notes on a word processor based on topical headings. Use two or three reference sources. This can be refined into a narrative (a good tip is to include as many clinical practice anecdotes as possible) that is not simply a regurgitation of one text. This also tends to strengthen the content knowledge of the instructor through critical reflection of course content and the relationship of clinical practice to course content.

Step 6 - Carry out the curriculum

This is an action-based step. The instructor must be a

reflective practitioner able to both act and reflect on the practice of teaching and learning. Sometimes one hears the comment from an instructor that, after years of teaching, the developed curriculum is as perfect as possible. This is not possible. Each group of students brings different challenges that lead to curriculum revision.

Step 7 - Align evaluation measures with the curriculum

A term paper requirement for a clinical course, for example, must be called into question. The usual object of a clinical course is to develop psychomotor skills. A term paper is usually assigned to develop cognitive or affective skills in a certain area.

Also, some curricula that claim to assess the affective domain are actually using forms and criteria suited for employee evaluation. The end goal of affective domain evaluation may be the production of an individual capable of being a good employee. However, evaluating a first-year radiography student and an experienced radiographer are only weakly synonymous.

Step 8 - Review and evaluation of the curriculum

This will lead to revision (feedback loop) or retention of the curriculum. Evaluation is accomplished by review in the short-term (grades in course), as well as in the long-term (registry scores and employer follow-up). Instructors also often revise material while teaching a course to facilitate student understanding. This should be reflected in the next syllabus.

Mid-course syllabus revision of student expectations should certainly be practiced with caution. Radiography students are, in general, detail-oriented, and adult learners dislike having expectations changed. Certainly, there will be an occasional need to include extra assignments based on needs. This can be due to poor student preparation, for example, or a change in certification exam criteria or local clinical practice. Caution is a key word in today's student-oriented environment.

CONCLUSION

Curriculum is a reflection of a program. A program's philosophy, personality, and quality are all discernible through the stated curriculum. This article has described the curriculum development process for radiography programs based on curriculum theory and professional concerns. These were stated as guidelines for radiography educators to facilitate curriculum development and alignment.

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